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USATECOM PROJECT NO. 2-3-0028-04

ROD&E PROJECT NO. NOT AVAILABLE

TECHNICAL SUPPORT TEST
OF
FUZE, MT, XM595 (SAFETY RELEASE)

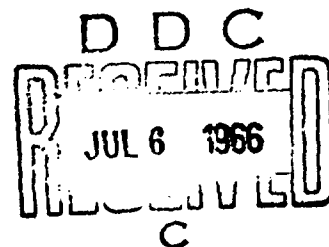
FINAL REPORT

BY

H. L. ADAMS

JUNE 1966

REPORT NO. DPS-2063



ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND

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ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND 21005

TECHNICAL SUPPORT TEST OF
FUZE, MT, XMS95 (SAFETY RELEASE)
RDT&E PROJECT NO. NOT AVAILABLE
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FINAL REPORT

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PREPARED BY: H. L. ADAMS

JUNE 1966

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ABSTRACT

In April and May 1966, 370 of the XM595 fuzes were tested at APG to evaluate the safety of the XM595 mechanical time fuze. The fuzes were subjected to simulated transportation - vibration tests at hot and cold temperatures, cold storage, and hot cycle tests, prior to firing. The firings consisted of 160 rounds of M1 cartridge from the M101A1, 105-mm weapon system at ambient temperatures (60 to 80°F), -65°F and +145°F; 50 rounds of M1 cartridge from the M108, 105-mm weapon system at +145°F; and 160 rounds of M107 projectile with charge, propelling, XM119E4 at zone 8 charge from the M109, 155-mm weapon system at ambient temperature, -65°F and +145°F. It is recommended that the XM595 mechanical time fuze be considered safe in any of the following weapon - ammunition combinations: cartridge, 105-mm, M1 in 105-mm howitzers, M101A1, M102, and M108; projectile, 155-mm, M107 with charges, propelling, M3, M4A1, and XM119 series as applicable in 155-mm howitzers, M114A1, and M109; and projectile, 8-inch, M106 with charges, propelling, M1, and M2 in 8-inch howitzers, M55, M110, and M115.

FOREWORD

This test was authorized and conducted in accordance with letter, GTE-FA, 26 April 1966, under USATECOM Project No. 2-3-0028-04 (Appendix IV). The RDT&E project number is not available.

References

1. Message 13410 from COMUSMACV, 18 April 1966, and retransmitted to USATECOM from USAMC on 22 April 1966.
2. Conference held at USAMC on 21 April 1966, subject: Jungle Canopy Penetration Fuze.

ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND 21005

USATECOM PROJECT NO. 2-3-0028-04

FINAL REPORT OF TECHNICAL SUPPORT TEST OF

FUZE, MT, XM595 (SAFETY RELEASE)

APRIL AND MAY 1966

SECTION 1. GENERAL

1.1 TEST OBJECTIVE

Test requirements in the form of QMR's, SDR's, or TC's do not exist. The test objective as determined by engineering judgment is to provide a safety release for fuze, MT, XM595.

1.2 RESPONSIBILITIES

Aberdeen Proving Ground (APG) was responsible for conducting and reporting the test.

1.3 DESCRIPTION OF MATERIEL

The XM595 mechanical time fuzes consisted of fuze safety adapter assemblies, booster cups, and booster pellets that had been removed from fuze, MTSQ, M564 and assembled to the fuze subassembly, M565 (ref page I-18).

The XM595 fuzes were packaged in metal can-type containers with 15 cans per wooden box. The box dimensions were 16-3/4 by 9-3/4 by 9-3/4 inches and had a gross weight of 48 pounds.

1.4 BACKGROUND

A requirement existed for a mechanical time fuze without point-detonating features that would function high explosive projectiles. There was an immediate need for a mechanical time fuze that would function on set time after penetrating a jungle canopy.

1.5 FINDINGS

1.5.1 Safety Release Test

1.5.1.1 Metal Parts Security (Recovery). Twenty XM595 fuzes were fired vertically for base impact recovery (ten were in the M1 projectile and were fired from the M101A1 weapon system and ten were in the M107 projectile and were fired from the M109 weapon system) at a chamber pressure adjusted to give 120% of each weapon rated maximum pressure (WRMP). All fuzes were set on 10 seconds and functioned normally without metal parts separation.

1.5.1.2 Functioning at Extreme Temperatures and Overpressures. Eleven fuzes failed to function out of the 350 fired as shown in Table I.

Table I. Functioning Data

<u>Group No.</u>	<u>Weapon Type</u>	<u>Per Cent of WRMP</u>	<u>Prefire Test of Fuze</u>	<u>Fuze Setting, sec</u>	<u>No. FTF</u>
4	M101A1	66	CS	15	4
4	M101A1	65	CS	60	2
4	M101A1	67	CTV	60	3
6	M109	117	HC	60	a1
6	M109	116	HTV	15	a1

^aThis round could have failed to function because of rotating band failure (insufficient spin to arm the fuze, ref Appendix III).

Legend: CS = Cold Soak, 7-day storage.
CTV = Cold transportation - vibration tests.
HC = Hot cycle, 7 days of continuous cycle.
HTV = Hot transportation - vibration tests.
WRMP = Weapon rated maximum pressure.

Note: There was an over-all 3.14% fuze functioning failure rate (including those with rotating band failures). Excluding those that had rotating band failures, the failure rate dropped to 2.57%.

The fuzes were vibrated at hot and cold temperatures in the same packaging as received at APG. This packing is not standard for the XM595 fuzes which should have been repacked before vibration. This was not discovered until too late. The damage to the fuzes when vibrated in this type of packaging was slight; however, damage to the containers was

greater but of no significance since this was not approved packing. At any rate, it had no effect on the safety evaluation of the fuzes (ref page I-19).

1.6 CONCLUSION

It is concluded that the XM595 mechanical time fuze is safe to store, transport, and launch at temperature extremes of -65 and +145°F (ref pars. 1.5.1.1 and 1.5.1.2).

1.7 RECOMMENDATION

It is recommended that XM595 mechanical time fuze be considered safe to store, transport, and launch between the temperature extremes of -65 and +145°F when used in combination with the following weapons and ammunition:

- a. Cartridge, 105-mm, M1 in weapon systems, howitzers, 105-mm, M101A1, M102, and M108.
- b. Projectile, 155-mm, M107 with charges, propelling, M3, M4A1, and XM119 series as applicable in weapon systems, howitzers, 155-mm, M114A1, and M109.
- c. Projectile, 8-inch, M106 with charges, propelling, M1 and M2 in weapon systems, howitzers, 8-inch, M55, M110, and M115.

SECTION 2. DETAILS OF TEST

2.1 INTRODUCTION

This test was designed to provide data to serve as a basis for evaluating the safety of the XM595 mechanical time fuze during transportation, storage, and launch under extreme temperatures and adverse firing conditions from the 105-mm and 155-mm howitzer weapon systems, M101A1, M108, and M109, respectively. Firings from the 8-inch weapon systems, M55, M110, and M115 were not necessary because greater setback forces, velocity, acceleration, and spin to the XM595 fuze are imparted by the 105-mm and 155-mm howitzer weapon systems.

2.2 SAFETY RELEASE TEST

2.2.1 Objective

To determine if the XM595, MT fuze is safe to transport, store, and launch from any of the weapon systems listed.

2.2.2 Criteria

The XM595, MT fuze must be safe to store, transport, and launch at temperature extremes between -65 and +145°F. Results of the test will be the basis for a safety release.

2.2.3 Method

The test firings for this test were conducted in the M101A1 and M108 105-mm howitzers and M109, 155-mm howitzer systems; however, the safety release for the XM595 fuze will include the 8-inch howitzer systems, M55, M110, and M115.

Table II presents a tabulation of prefire and firing conditions.

Table II. Firing Conditions

Group No.	No. Rds	Weapon System Used	Proj		Metal Parts Security Phase	Proj and Fuze Temp, °F	Prop. Chg		No. and Prefire Test of Fuze	Expected PEP, psi/100	Chg, % WRMP
			Type	Filler			Type	Temp, °F			
1	10	M101A1	M1	Inert	Functioning Phase	Amb	M67	+155	None	470	120
2	10	M109	M107	Inert		Amb	XM119E4	+155	None	605	120
3	100	M101A1	M1	TNT	Functioning Phase	+145	M67	+155	75 HC 15 HTV	448	115
4	50	M101A1	M1	TNT		- 65	M67	- 65	10 HN 30 CS 15 CTV	Resultant	-
5	50	M108	M1	TNT	Functioning Phase	+145	M67	+155	5 CN 50 HC	448	all 5
6	100	M109	M107	TNT		+145	XM119E4	+155	75 HC 15 HTV 10 HN	580	115
7	50	M109	M107	TNT	Functioning Phase	- 65	XM119E4	- 65	30 CS 15 CTV 5 N	Resultant	-

A value of 39,000 psi was used as weapon rated maximum pressure since the M1 cartridge was used.

Legend: WRMP = Weapon rated maximum pressure.

HC = Hot cycle, 7-day temperature cycle from 90 to +155°F.

HTV = Hot transportation - vibration tests at +145°F.

II = Hot normal soak for at least 18 hours prior to firing.

CS = Cold soak for 7 days at -65°F.

CTV = Cold transportation - vibration tests at -65°F.

CN = Cold normal soak for at least 10 hours prior to firing.

PEP = Piezo equivalent pressure.

Observations recorded include the following:

- a. Muzzle velocity by sky screens (functioning phase only).
- b. Weapon chamber pressure.
- c. Weapon elevation.
- d. Fuze setting and time of flight to burst (functioning phase only).
- e. Functioning.
- f. Time of firing.
- g. Projectile weight.
- h. Other unusual occurrences.

2.2.4 Results

Table III presents a summary of the round-by-round data for metal parts security of fuze, MT, XM595 fired vertically for base impact recovery.

Table III. Metal Parts Security

Group No.	No. Rds		Cons	Measured PEP, psi/100			Chg. % WRMP,	No.	Mean	TOF, sec	Remarks
	Fired	Recovered		Mean	Max	Min	mean		Cons		
Weapon System: M109, 155-mm howitzer.											
2	10	10	3	591	607	579	117	9	107	Zone 6 plus 8 oz.	
			7	589	602	577	117			Zone 8 plus 10 oz.	
Weapon System: M101A1, 105-mm howitzer.											
1	10	10	b9	474	486	458	122	10	78	Zone 7 plus 3-3/4 oz.	

^aOne lost.

^bOne set of gages lost.

Notes: All rounds were recovered and the fuzes were checked for functioning; all fuzes functioned satisfactorily.

All the fuzes were modified for this firing by replacing the tetryl pellet with a wooden plug so functioning would not damage the remainder of the fuze.

Table IV presents a summary of the round-by-round data for functioning while being subjected to extreme temperatures and pressures.

Table IV. Summary of Functioning Data

Group No.	No. Fired	Rds Cons	Mean Press., psi/100	Chg, %		Mean Prefire Test of Set., Fuze	Fuze sec	T to B, sec		No. FTF	Remarks
				Mean WRMP	Mean MV, fps			Mean	Max Disp		
Weapon System: M101A1, 105-mm howitzer.											
3	40	^a 38	433	111	1697	HC	15	14.38	0.79	0	One lost time.
3	35	34	430	110	1689	HC	60	58.25	1.94	0	
3	8	8	430	110	1694	HTV	15	14.36	0.23	0	
3	7	7	421	108	1676	HTV	60	58.34	1.03	0	
3	5	5	434	111	1692	HN	15	14.41	0.32	0	
3	5	5	425	109	1682	HN	60	58.46	0.94	0	
4	15	15	259	66	1454	CS	15	14.94	1.26	4	One FUW.
4	15	15	254	65	1439	CS	60	59.48	1.64	2	
4	8	8	253	65	1457	CTV	15	15.22	2.02	0	
4	7	7	260	67	1444	CTV	60	59.76	0.91	3	
4	5	5	257	66	1454	CN	15	15.15	1.26	0	
Weapon System: M108, 105-mm howitzer.											
5	25	^b 24	453	^c 116	1786	HC	60	57.63	2.61	0	Two LIC.
5	25	^b 24	474	^c 122	1782	HC	15	14.02	0.62	0	
Weapon System: M109, 155-mm howitzer.											
6	25	24	585	116	2364	HC	15	14.54	0.60	0	One lost time.
6	13	12	592	117	2369	HC	60	59.02	2.14	1	One lost time.
6	10	^d 10	563	112	2325	HC	60	58.38	1.33	0	
6	9	^e 9	591	117	2354	HC	60	58.60	1.14	0	
6	10	^f 10	582	115	2344	HC	60	59.07	1.37	0	

^aTwo rounds fired at charge zone 7 only (without excess propellant added).

^bOne round fired at charge zone 7 only (without excess propellant added).

^cValue of 39,000 psi was used as the weapon rated maximum pressure since the M1 cartridge was being used.

^dOne round fired at charge zone 8 only (without excess propellant added).

^eThese rounds were fired at charge zone 8 plus 4 ounces.

^fThese rounds were fired at charge zone 8 plus 2 ounces.

Table IV (Cont'd)

Group No.	No. Fired	Rds Cons	Mean Press., psi/100	Chg, % WRMP	Mean MV, fps	Prefire Fuze Test of Set., Fuze sec	T to B, sec			No.	Remarks
							Mean	Max	Disp		
6	7	f 7	596	118	2351	HTV	60	59.27	1.38	0	
6	6	f 6	584	116	2350	HTV	15	14.66	0.36	1	
6	2	e 2	613	122	2378	HTV	15	14.61	0.16	0	
6	8	d, f 7	580	115	2344	HC	15	14.69	0.27	0	
6	10	10	594	118	2354	HN	15	14.83	0.63	0	One false start.
7	15	15	418	83	2151	CS	15	14.57	1.08	0	
7	15	15	416	83	2138	CS	60	58.80	2.97	0	
7	8	8	418	83	2152	CTV	15	14.69	2.02	0	
7	7	7	418	83	2150	CTV	60	59.13	1.62	0	
7	5	5	411	82	2144	CN	15	14.66	0.56	0	

^dOne round fired at charge zone 8 only (without excess propellant added).

^eThese rounds were fired at charge zone 8 plus 4 ounces.

^fThese rounds were fired at charge zone 8 plus 2 ounces.

Legend: HC = Hot cycle, 7-day temperature cycle from 90 to +155°F.
 HTV = Hot transportation - vibration tests at +145°F.
 HN = Hot normal soak (at least 18 hours prior to firing) at +145°F.
 CS = Cold soak for 7 days at -65°F.
 CTV = Cold transportation - vibration tests at -65°F.
 CN = Cold normal soak for at least 18 hours prior to firing at -65°F.
 FUW = Functioned under water.
 LIC = Lost in clouds.
 T to B = Time to burst.
 WRMP = Weapon rated maximum pressure.

The smear film was developed on those rounds which gave indication of trouble (yaw, dud, or noisy). The results of these are shown in Appendix III, showing the rotating band off two of these rounds.

Note: Seven of the XM595 fuzes fired in groups 3 through 5 were inadvertently set by turning the time indicator in reverse (opposite direction from the arrow).

2.2.5 Observations

Two of the XM119E4 propelling charges to be fired at -65°F failed to ignite, apparently because of insufficient ignition of the clean burning igniter material (CBI). After a waiting period of 10 to 15 minutes, the charges were removed from the chamber and were inspected for the cause of failure. The inspection revealed that the CBI material had burned off the outer layer of the igniter bag but failed to penetrate the inner layer next to the Benite strands, thus preventing ignition of the charge.

The XM119E4 propelling charge also had several hangfires when fired at -65°F. Of the ten ignition delays that occurred, the greatest time lapse was 1.2 seconds (approximate, as read from an electric timer used on the smear cameras and observed by the photographer).

One primer misfire occurred on the M82 primer, lot LS-103-25, which was fired at ambient temperature.

The rotating bands came off two of the M107 projectiles that were fired at +145°F. These rounds were especially noisy at the gun site. The fuzes on both these rounds failed to function the projectile, probably because of insufficient spin.

SECTION 3. APPENDICES

APPENDIX I - TEST DATA

ITEM UNDER TEST

Fuze, MT, XM595, lot LS-1-2 (ref ammunition data card, page I-17).

SUPPORTING FACILITIES AND MATERIALS

Weapon System:

Howitzer, 105-MM, Towed, M101A1.

Gun, 105-mm howitzer, model M2A2, No. 19709.
Tube, 105-mm howitzer, model M2A2, No. 54142.
Recoil mechanism, 105-mm howitzer, model M2A1, No. 15956.
Carriage, 105-mm howitzer, model M2A2, No. 11173.

Howitzer, 105-MM, SP, Light, M108.

Gun, 105-mm howitzer, model XM103, No. 177.
Tube, 105-mm howitzer, model XM103, No. 58202.
Recoil mount combination, 105-mm howitzer, model XM139, No. 166.
Vehicle, tracked, self-propelled, model M108, No. 12U802.

Howitzer, 155-MM, SP, Light, M109.

Gun, 155-mm howitzer, model M126, No. 1363.
Tube, 155-mm howitzer, model M126, No. 17863.
Recoil mount combination, 155-mm, model XM127, No. 183.
Vehicle, tracked, self-propelled, model M109, No. 12V203.

Howitzer, 155-MM, SP, Light, M109.

Gun, 155-mm howitzer, model T255E3, No. 13.
Tube, 155-mm howitzer, model M126E1, No. 18346.
Recoil mount combination, 155-mm, model XM127, No. 20.
Vehicle, tracked, self-propelled, model M109, No. 12V023.

Howitzer, 155-MM, SP, Light, M109.

Gun, 155-mm howitzer, model M126, No. 895.
Tube, 155-mm howitzer, model M126, No. 18257.
Recoil mount combination, 155-mm howitzer, model XM127, No. 839.
Vehicle, tracked, self-propelled, model M109, No. 12P410.

Howitzer, 105-MM, Towed, M101A1.

Gun, 105-mm howitzer, model M2A2, No. 22862.
Tube, 105-mm howitzer, model M2A2, No. 56134.
Recoil mechanism, 105-mm howitzer, model M2A4, No. 8579.
Carriage, 105-mm howitzer, model M2A2, No. 11063.

Ammunition:

Vertical Recovery.

Projectile, 105-mm, HE (inert-filled to 33.00 pounds with fuze),
lot NPK-40-4.
Charge, propelling, 105-mm, M67, zone 7, lots SUN-B-61287/61387.
Case, cartridge, 105-mm, M14, lot RMO-147-12.
Primer, percussion, M28B2, lot KOP-10-199.
Fuze, dummy, M73 (spotters).
Fuze, MT, XM595 (test rounds).
Propellant, M1, MP, lot FA-61180, 0.0262-inch web, added to charges
to yield a chamber pressure of 120 to 125% of weapon RMP.
Projectile, 155-mm, HE (inert-filled to 95.00 pounds with fuze),
lot RFO-1-97.
Charge, propelling, 155-mm, XM119E4 and XM119, zone 8 supercharge,
lots IND-SR-29-65 and RAD-64651, respectively.
Primer, percussion, M82, lot LS-103-25.
Fuze, dummy, M73 (spotters).
Fuze, MT, XM595, lot LS-1-2 (test rounds).
Propellant, M30E1, MP, 0.053-inch web, lot RAD-63547, added to
zone 8 charge to yield a chamber pressure of 120 to 125% of
weapon RMP.

Note: Fuze, MT, XM595 was modified at APG by replacing the tetryl pellets
with wooden ones (vertical recovery only).

Functioning Phase.

Cartridge, 105-mm, semifixed, HE, TNT, M1 with charge, propelling,
105-mm, M67, zone 7 without fuze, lot JA-22-7 (all 105-mm
rounds, both weapons).
Projectile, 155-mm, HE, TNT, M107, zone 4 weight, lot RVA-6-79
(all 155-mm rounds).
Charge, propelling, 155-mm, XM119E4, supercharge, zone 8, lot
IND-SR-29-65.
Charge, propelling, 155-mm, XM119, supercharge, zone 8, lot
RAD-64651.
Fuze, MT, XM595, lot LS-1-2 (test fuze).
Primer, percussion, M82, lot LS-103-25.

Facilities:

Gun Positions:

Position No. 3 to impact on "I" field (vertical recovery).
Fuze range; azimuth, 46° from 0° south (functioning phase).

Instrumentation:

A 35-mm smear camera was placed 30 and 50 feet from the muzzle on low and high angle firings, respectively.
Two sky screens were used to sense projectile velocity on all rounds in the functioning phase.
Gages, high pressure, M11, with copper sphere lot 1-63, two per round, all rounds.

ROUND-BY-ROUND DATA

Legend

PE = Piezo equivalent.
HC = Hot cycle test from 90°F to 155°F, 7 days.
HN = Hot temperature, normal storage at +145°F (18 hours).
HTV = Hot transportation - vibration at +145°F.
CS = Cold soak at -65°F, 7 days.
CN = Cold temperature, normal soak at -65°F (18 hours).
CTV = Cold transportation - vibration at -65°F.

Vertical Recovery Phase

Time Fired	Rd No.	Quadrant		Proj No.	Plus Prop., oz	PEP, psi/1000	TOF, sec	Seating, in.
		Elev Deg Min	Defl Deg Min					

Group 2

Date Fired: 3 May 1966. Propellant Lot: XM119.
 Fuze Type: M73. Zone: 8.
 Projectile Lot: RFO-1-97. Temperature: +155°F.
 Projectile Type: M107.
 Projectile Weight: 95.00 pounds.

1103	A	88	30	0	-		55.6	109	29-9/16
1127	B	89	15	10 R	-	2	55.4	108	29-9/16
1135	C	90		20 R	-	5	57.2	108	29-9/16
1150	D	89	15	35 R	-	8	59.8	107	29-5/8

Fuze Type: XM595.

1209	i	89	8	10 R	A	8	60.7	110	29-5/8
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Propellant Lot: XM119E4.

1305	2	89	12	55 R	B	8	58.8	107	29-5/8
1308	3	89	12	40 R	C	8	57.9	106	29-5/8
1318	4	89	12	40 R	D	10	59.4	108	29-5/8
1326	5	89	12	45 R	E	10	59.0	106	29-5/8
1333	6	89	12	45 R	F	10	59.0	106	29-5/8
1340	7	89	12	53 R	G	10	60.2	107	29-5/8
1350	8	89	12	1 R	H	10	57.7	106	29-5/8
1357	9	89	17	1 R	I	10	57.7	Lost	29-5/8
1408	10	89	17	1 R	J	10	59.6	107	29-5/8

Group 1

Date Fired: 4 May 1966. Propellant Lot: M67.
 Fuze Type: M73. Zone: 7.
 Projectile Lot: NPK-40-4.
 Projectile Type: M1.
 Projectile Weight: 33.00 pounds.

1000	A	88		15 L	-		41.0		
1010	B	89		40 L	-	2-1/4	44.1		
1016	C	90		1 25 L	-	3-3/4	47.7	79	

<u>Time</u> <u>Fired</u>	<u>Rd</u> <u>No.</u>	<u>Quadrant</u>		<u>Proj</u> <u>No.</u>	<u>Prop.,</u> <u>oz</u>	<u>PEP,</u> <u>psi/1000</u>	<u>TOF,</u> <u>sec</u>	<u>Seating,</u> <u>in.</u>
		<u>Elev</u> <u>Deg Min</u>	<u>Defl</u> <u>Deg Min</u>					
1033	1	90	1 32 L	A	3-3/4	48.6	79	
1038	2	90	1 32 L	B	3-3/4	45.8	78	
1043	3	90	1 32 L	C	3-3/4	46.6	78	
1046	4	90	1 32 L	D	3-3/4	48.6	78	
1051	5	90	1 32 L	E	3-3/4	46.7	78	
1055	6	90	1 32 L	F	3-3/4	46.3	78	
1059	7	90	1 32 L	G	3-3/4		78	
1103	8	90	1 32 L	H	3-3/4	48.0	78	
1108	9	90	1 32 L	I	3-3/4	47.6	78	
1112	10	90	1 32 L	J	3-3/4	48.0	78	

Fuze Type: XM595.

Notes: Temperature at 1150 hours on 3 May was 58°F.
 Temperature at 1046 hours on 4 May was 61°F.
 All XM595 fuzes were recovered and inspected for functioning; all
 20 fuzes functioned.
 All XM595 fuzes were set on 10 seconds.
 Rounds A, B, and C (Group 2) floated.

Functioning Phase

APG Sample No.	Tube Rd No.	Proj Wt, lb	Time Fired	PEP, psi/100	MV, fps	Time to Funct, sec	Pretest of Fuze	Remarks
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Group 3

Date Fired: 7 May 1966.
Projectile and Fuze Temperature: +145°F.
Weapon: M2A2 howitzer.
Propellant Charge: M67, zone 7 at +155°F.
Tube Elevation: 255 mils.
Fuze Setting: 15 seconds.

Six ounces of M1 propellant was added to all rounds except tube rounds 3194 and 3195 where 0 and 3 ounces were added, respectively.

1	3194	33.04	1028	353	1569	14.53	HC	
2	3195	32.75	1045	398	1636	14.46	HC	
3	3196	32.85	1055	428	1696	14.54	HC	
4	3197	33.06	1105	435	1740	14.55	HC	
5	3198	33.01	1109	442	1694	14.43	HC	
6	3199	33.08	1111	435	1692	14.48	HC	
7	3200	32.57	1112	438	1697	14.33	HC	
8	3201	33.06	1114	440	1693	14.36	HC	
9	3202	33.03	1116	436	1693	14.35	HC	
10	3203	32.98	1119	434	1693	14.49	HC	
11	3204	33.01	1121	428	1689	14.49	HC	
12	3205	32.73	1123	435	1701	14.34	HC	
13	3206	32.95	1124	432	1743	14.37	HC	
14	3207	32.74	1126	430	1696	14.44	HC	
15	3208	32.83	1128	436	1695	14.34	HC	
16	3209	32.75	1130	440	1700	14.32	HC	
17	3210	32.85	1132	439	1696	14.46	HC	
18	3211	33.04	1134	433	1691	14.32	HC	
19	3212	32.82	1136	428	1697	14.53	HC	
20	3213	32.77	1138	430	1696	14.39	HC	
21	3214	32.68	1140	434	1700	14.21	HC	
22	3215	32.88	1142	433	1693	14.20	HC	
23	3216	32.98	1144	435	1693	14.32	HC	
24	3217	32.84	1146	432	1695	14.24	HC	
25	3218	33.09	1148	432	1692	14.14	HC	
26	3219	32.80	1150	418	1689	14.36	HC	
27	3220	32.82	1152	430	1698	14.40	HC	
28	3221	32.81	1155	430	1696	14.33	HC	
29	3222	32.87	1156	429	1699	14.48	HC	
30	3223	33.10	1158	430	1689	14.47	HC	
31	3224	33.07	1159	431	1691	14.57	HC	

APG Sample No.	Tube Rd No.	Proj Wt, lb	Time Fired	PEP, psi/100	MV, fps	Time to Funct, sec	Pretest of Fuze	Remarks
32	3225	32.70	1310	420	1694	14.33	HC	
33	3226	33.03	1312	432	1691	14.24	HC	
34	3227	32.72	1313	439	1701	14.15	HC	Two turns to set fuze.
35	3228	32.64	1316	431	1699	14.29	HC	
36	3229	32.84	1318	432	1695	14.28	HC	
37	3230	32.91	1320	433	1694	14.29	HC	
38	3231	32.70	1321	430	1695	14.18	HC	
39	3232	32.96	1323	436	1693	14.41	HC	
40	3233	32.92	1327	438	1695	14.93	HC	Reverse turn to set.
41	3234	32.71	1329	434	1697	14.32	HTV	
42	3235	33.00	1331	439	1692	14.38	HTV	
43	3236	33.09	1332	428	1689	14.38	HTV	
44	3237	32.76	1334	430	1694	14.34	HTV	
45	3238	32.73	1336	422	1694	14.31	HTV	
46	3239	32.89	1338	433	1694	14.44	HTV	
47	3240	32.77	1340	438	1700	14.26	HTV	
48	3241	32.97	1343	418	1695	14.49	HTV	Reverse turn to set.
49	3242	32.90	1346	433	1693	14.26	HN	
50	3243	33.01	1348	430	1689	14.42	HN	
51	3244	32.92	1349	431	1692	14.56	HN	
52	3245	33.24	1351	435	1687	14.24	HN	
53	3246	32.84	1353	438	1697	14.56	HN	Reverse turn to set.

Group 4

Projectile, propellant charge, and fuze fired at -65°F at charge zone 7.

54	3247	32.91	1359	274	1452	15.18	CS	
55	3248	32.84	1401	254	1457	14.44	CS	
56	3249	32.74	1404	252	1462	14.32	CS	
57	3250	33.04	1406	264	1444	14.66	CS	
58	3251	33.06	1408	268	1453	14.96	CS	
59	3252	33.08	1410	268	1454	15.58	CS	
60	3253	32.79	1412	246	1459	18.95	CS	Time to impact - dud.
61	3254	32.62	1414	258	1462	14.84	CS	
62	3255	33.01	1416	252	1449	15.29	CS	
63	3256	32.81	1418	252	1459	14.72	CS	
64	3257	33.01	1420	249	1452	18.74	CS	Time to impact - dud.

APG Sample No.	Tube Rd No.	Proj Wt, lb	Time Fired	PEP, psi/100	MV, fps	Time to Funct, sec	Pretest of Fuze	Remarks
65	3258	32.87	1422	270	1452	18.73	CS	Time to impact - dud.
66	3259	32.93	1424	264	1456	15.18	CS	
67	3260	32.71	1426	263	1450	18.64	CS	Time to impact - dud.
68	3261	33.22	1428	256	1446	15.21	CS	
69	3262	32.96	1430	242	1460	15.34	CTV	
70	3263	32.74	1432	262	1456	14.81	CTV	
71	3264	32.91	1447	244	1457	14.82	CTV	
72	3265	32.69	1449	246	1457	14.81	CTV	
73	3266	32.71	1451	258	1457	15.17	CTV	
74	3267	32.92	1453	256	1452	15.18	CTV	
75	3268	32.94	1454	254	1458	14.80	CTV	
76	3269	32.86	1456	263	1458	16.82	CTV	
77	3270	33.03	1458	252	1454	15.88	CN	
78	3271	32.97	1500	241	1447	15.40	CN	
79	3272	33.02	1502	270	1456	15.01	CN	
80	3273	32.81	1505	258	1455	14.82	CN	
81	3274	32.90	1506	264	1457	14.62	CN	

Group 3

Projectile and Fuze Temperature: +145°F.
 Propellant Charge: M67, zone 7 at +155°F (plus 6 ounces ambient).
 Tube Elevation: 1070 mils.
 Fuze Setting: 60 seconds.

82	3275	32.98	1536	433	1712	Lost	HC
83	3276	32.99	1540	438	1712	58.16	HC
84	3277	33.05	1550	418	1687	58.20	HC
85	3278	32.79	1553	433	1696	58.05	HC
86	3279	33.18	1557	442	1696	57.32	HC
87	3280	33.06	1559	440	1695	58.37	HC
88	3281	33.07	1602	430	1688	58.51	HC
89	3282	32.97	1605	432	1692	58.03	HC
90	3283	32.85	1608	428	1696	58.42	HC
91	3284	32.99	1610	430	1689	57.99	HC

Date Fired: 8 May 1966.

92	3285	32.65	0915	444	1700	58.76	HC	Zone 7 only.
93	3286	32.64	0926	436	1704	58.50	HC	Zone 7 plus 6 ounces hereafter.
94	3287	32.78	0931	442	1696	57.96	HC	
95	3288	32.93	0934	441	1696	58.00	HC	
96	3289	33.24	0940	428	1684	58.06	HC	
97	3290	32.93	0943	442	1692	59.39	HC	
98	3291	32.70	0944	431	1694	57.88	HC	

APG Sample No.	Tube Rd No.	Proj Wt, lb	Time Fired	PEP, psi/100	MV, fps	Time to Funct, sec	Pretest of Fuze	Remarks
99	3292	32.65	0947	432	1695	58.30	HC	
100	3293	32.65	0950	442	1696	59.02	HC	
101	3294	32.87	0952	437	1691	58.02	HC	
102	3295	32.77	0955	428	1688	58.11	HC	
103	3296	32.70	0957	423	1688	58.02	HC	
104	3297	33.06	0959	423	1678	57.68	HC	
105	3298	32.92	1001	450	1694	58.50	HC	

Group 4

Projectile, fuze, and charge at -65°F at zone 7 charge.

106	3299	32.91	1039	254	1434	-	CS	Time lost - dud.
107	3300	32.66	1044	264	1448	60.20	CS	
108	3301	32.96	1047	263	1437	61.02	CS	Time to impact - dud.
109	3302	33.30	1049	260	1439	60.18	CS	
110	3303	33.01	1052	248	1438	58.64	CS	
111	3304	33.05	1054	262	1439	60.02	CS	
112	3305	32.81	1057	252	1437	59.28	CS	
113	3306	33.07	1059	268	1428	59.34	CS	
114	3307	32.83	1101	250	1442	58.74	CS	
115	3308	32.98	1105	244	1445	59.81	CS	
116	3309	33.11	1107	244	1438	59.07	CS	
117	3310	33.15	1109	235	1435	60.36	CS	Functioned under water.
118	3311	32.73	1111	261	1451	58.98	CS	
119	3312	32.92	1114	250	1435	59.28	CS	
120	3313	32.68	1117	260	1442	60.28	CS	
121	3314	33.03	1120	258	1437	60.45	CTV	Functioned under water.
122	3315	32.83	1123	272	1450	60.01	CTV	
123	3316	32.81	1125	252	1442	60.71	CTV	Time to impact - dud.
124	3317	32.77	1127	264	1442	60.09	CTV	
125	3318	32.91	1129	250	1437	59.18	CTV	
126	3319	32.78	1131	251	1449	61.23	CTV	Time to impact - dud.
127	3320	33.39	1134	270	1442	60.98 A	CTV	Reverse turn to set; time to impact - dud.

Group 3

Projectile and Fuze Temperature: +145°F.

Propellant Charge: Zone 7 at +155°F plus 6 ounces ambient.

128	3321	32.71	1241	426	1688	58.99	HN
129	3322	33.08	1244	422	1677	58.73	HN
130	3323	32.74	1255	422	1681	58.32	HN
131	3324	32.92	1257	438	1689	58.05	HN

APG Sample No.	Tube Rd No.	Proj Wt, lb	Time Fired	PEP, psi/100	MV, fps	Time to Funct, sec	Pretest of Fuze	Remarks
132	3325	33.20	1259	418	1675	58.20	HN	
133	3326	32.93	1301	428	1686	58.58	HC	Two turns to set.
134	3327	32.75	1303	413	1684	58.31	HC	
135	3328	32.98	1305	428	1686	58.42	HC	
136	3329	32.92	1307	426	1676	58.23	HC	
137	3330	33.16	1309	422	1671	58.36	HC	
138	3331	33.15	1312	426	1674	58.24	HC	
139	3332	32.74	1318	418	1678	57.45	HC	
140	3333	32.78	1320	424	1681	58.20	HC	
141	3334	32.66	1322	415	1684	58.24	HC	
142	3335	32.79	1324	424	1679	58.38	HC	
143	3336	33.22	1327	426	1671	58.90	HC	Reverse turn to set.
144	3337	33.01	1331	416	1675	57.98	HTV	
145	3338	32.99	1334	428	1676	58.03	HTV	Left trail of weapon is cracked.
146	3339	33.08	1339	420	1670	59.01	HTV	Left trail of weapon is cracked.
147	3340	32.76	1341	432	1682	58.00	HTV	Left trail of weapon is cracked.
148	3341	33.03	1343	416	1670	58.53	HTV	Left trail of weapon is cracked.
149	3342	32.72	1345	421	1681	58.17	HTV	Left trail of weapon is cracked.
150	3343	32.87	1347	414	1675	58.64	HTV	Reverse turn to set.

Group 5

Weapon: M108, SP howitzer, No. 12V802.
Propellant Charge: +155°F plus 6 ounces (ambient).
Tube Elevation: 1020 mils.

151	968	32.81	1428	388	1664	58.02	HC	Zone 7 only, all others plus 6 ounces.
152	969	33.25	1432	440	1780	57.38	HC	
153	970	33.29	1451	450	1777	57.24	HC	
154	971	32.72	1455	458	1791	56.88	HC	
155	972	32.86	1507	458	1793	58.27	HC	
156	973	32.72	1510	450	1791	57.84	HC	
157	974	33.16	1512	458	1783	57.58	HC	Noisy round.
158	975	32.87	1515	461	1791	57.37	HC	
159	976	32.83	1517	450	1786	57.08	HC	
160	977	32.72	1519	455	1793	57.56	HC	
161	978	32.82	1521	454	1789	57.64	HC	
162	979	33.03	1523	456	1786	57.87	HC	

APG Sample No.	Tube Rd No.	Proj Wt, lb	Time Fired	PEP, psi/100	MV, fps	Time to Funct, sec	Pretest of Fuze	Remarks
163	980	32.80	1526	444	1786	58.10	HC	
164	981	32.80	1528	463	1791	57.53	HC	
165	982	32.77	1530	458	1790	57.76	HC	
166	983	32.86	1533	456	1786	57.61	HC	
167	984	32.86	1535	452	1783	57.13	HC	
168	985	32.70	1537	450	1786	57.66	HC	
169	986	32.88	1539	444	1781	58.09	HC	
170	987	33.03	1541	458	1784	57.88	HC	
171	988	32.94	1544	454	1784	57.70	HC	
172	989	32.79	1546	440	1785	57.91	HC	
173	990	33.05	1549	454	1785	57.86	HC	
174	991	32.92	1551	452	1784	57.48	HC	
175	992	33.14	1554	462	1784	57.74	HC	Reverse turn to set.

Group 5

Date Fired: 9 May 1966.
 Tube Elevation: 175 mils.
 Fuze Setting: 15 seconds.

Tube round No. 993 was zone 7 only, all others plus 6 ounces.

176	993	32.77	1018	377	1659	Lost	HC	Tube elevation, 234 mils. in clouds.
177	994	32.52	1020	460	1787	Lost	HC	Tube elevation, 200 mils. in clouds.
178	995	32.81	1029	434	1796	14.93	HC	Tube elevation, 150 mils (func- tioned under water); time to impact.
179	996	32.74	1038	434	1793	14.18	HC	Tube elevation, 175 mils hereafter.
180	997	32.78	1042	482	1790	14.07	HC	
181	998	32.74	1045	479	1788	14.02	HC	
182	999	32.93	1048	478	1783	14.42	HC	
183	1000	33.05	1050	479	1779	14.16	HC	
184	1001	33.04	1052	475	1776	14.37	HC	
185	1002	33.06	1054	472	1780	14.12	HC	
186	1003	33.18	1056	492	1779	13.87	HC	
187	1004	32.92	1058	482	1781	14.06	HC	
188	1005	32.40	1100	472	1783	13.95	HC	
189	1006	33.13	1102	482	1779	13.93	HC	
190	1007	32.75	1104	476	1786	13.80	HC	
191	1008	32.95	1106	480	1783	13.82	HC	
192	1009	32.86	1107	475	1780	13.92	HC	

APG Sample No.	Tube Rd No.	Proj Wt, lb	Time Fired	PEP, psi/100	MV, fps	Time to Funct, sec	Pretest of Fuze	Remarks
193	1010	33.12	1109	473	1774	14.01	HC	
194	1011	33.14	1111	483	1777	13.93	HC	
195	1012	32.86	1113	476	1780	13.92	HC	
196	1013	33.15	1115	479	1776	14.05	HC	
197	1014	32.91	1117	478	1781	14.03	HC	
198	1015	33.15	1119	480	1776	14.03	HC	
199	1016	32.85	1121	474	1782	13.99	HC	
200	1017	32.83	1123	478	1781	13.85	HC	

Group 7

Weapon: Howitzer, 155-mm, SP, No. 12V203.
Tube Elevation: 162 mils.

Projectile, fuze, and propellant charge fired at -65°F at zone 8 charge.

201	553	95.41	1419	422	2160	14.58	CS	Hangfire.
202	554	95.71	1426	428	2154	14.62	CS	Hangfire.
203	555	94.71	1430	420	2157	14.97	CS	
204	556	94.91	1434	415	2151	14.60	CS	
205	557	94.61	1438	419	2149	14.54	CS	
206	558	94.91	1441	418	2148	14.74	CS	Hangfire.
207	559	94.81	1452	416	2151	14.53	CS	Hangfire.
208	560	94.91	1456	413	2137	14.59	CS	
209	561	95.41	1459	414	2150	14.28	CS	
210	562	95.01	1502	415	2150	14.40	CS	Hangfire.
211	563	95.31	1505	416	2157	15.05	CS	Hangfire.
212	564	94.71	1509	418	2149	14.80	CS	Hangfire.
213	565	95.31	1512	416	2147	14.17	CS	
214	566	95.01	1516	412	2144	14.69	CS	Hangfire.
215	567	95.21	1527	433	2162	13.97	CS ^a	
216	568	95.07	1540	421	2155	14.22	CTV	
217	569	94.61	1543	418	2150	13.90	CTV	
218	570	94.71	1545	422	2154	14.46	CTV	
219	571	95.11	1548	418	2157	14.28	CTV	

Date Fired: 10 May 1966.

220	572	94.91	0950	416	2141	14.89	CTV	
221	573	94.61	0954	416	2155	14.77	CTV	
222	574	94.81	0957	421	2158	15.11	CTV	

^aPrimer ignited CBI, which burned off without igniting the charge.

APG Sample No.	Tube Rd No.	Proj Wt, lb	Time Fired	PEP, psi/100	MV, fps	Time to Funct, sec	Pretest of Fuze	Remarks
223	575	95.01	1000	412	2148	15.92	CTV	
224	576	94.71	1004	410	2154	14.45	CN	Hangfire.
225	577	94.91	1033	415	2137	14.68	CN	
226	578	95.01	1057	406	2158	14.61	CN	
227	579	95.11	1100	412	2129	15.01	CN	
228	580	94.91	1104	412	2140	14.57	CN	

Group 6

Projectile and Fuze Temperature: +145°F.

Propellant Charge: XM119E4 at zone 8 at +155°F, plus 8 ounces (ambient).

229	581	95.51	1107	543	2297	14.72	HC	Zone 8 only.
230	582	95.11	1113	593	Lost	14.45	HC	Zone 8 plus 8 ounces hereafter.
231	583	94.71	1124	588	Lost	14.63	HC	
232	584	94.91	1133	573	2351	14.74	HC	
233	585	94.71	1138	570	2345	14.30	HC	
234	586	95.11	1142	585	2370	14.88	HC	
235	587	94.91	1146	590	2367	14.54	HC	
236	588	95.11	1153	577	2350	14.34	HC	
237	589	94.81	1331	581	2360	14.30	HC	
238	590	95.31	1335	585	2392	-	HC	Extra noisy, rotat- ing band off. Dud.
239	591	95.31	1339	592	2385	14.36	HC	
240	592	95.11	1342	583	2374	14.29	HC	
241	593	95.31	1434	590	2362	14.39	HC	
242	594	95.01	1452	594	2365	14.87	HC	
243	595	94.81	1455	596	2369	14.44	HC	
244	596	94.71	1503	590	2370	14.84	HC	Misfire, 1459 hours.
245	597	94.71	1506	600	2378	14.28	HC	
246	598	94.81	1509	590	2363	14.45	HC	
247	599	95.21	1512	585	2359	14.77	HC	
248	600	94.81	1515	550	2337	14.57	HC	
249	601	94.51	1519	596	2374	14.63	HC	
250	602	94.91	1522	574	2343	14.65	HC	
251	603	94.91	1526	600	2371	14.32	HC	
252	604	94.71	1528	561	2363	14.84	HC	
253	605	95.41	1532	600	2362	14.45	HC	

APG Sample No.	Tube Rd No.	Proj Wt, lb	Time Fired	PEP, psi/100	MV, fps	Time to Funct, sec	Pretest of Fuze	Remarks
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Group 7

Tube Elevation: 740 mils.
Fuze Setting: 60 seconds.

Projectile, fuze, and charge at -65°F.

254	606	94.61	1621	454	2154	57.24	CS	
255	607	95.11	1626	416	2130	59.35	CS	
256	608	94.91	1630	420	2143	58.04	CS	
257	609	95.31	1634	422	2139	58.69	CS	
258	610	94.91	1636	412	2135	58.84	CS	
259	611	94.91	1704	418	2138	57.99	CS	
260	612	94.41	1707	410	2138	58.56	CS	
261	613	94.71	1710	414	2147	58.97	CS	
262	614	94.91	1714	406	2131	60.21	CS	
263	615	94.71	1716	410	2140	58.64	CS	
264	616	95.31	1720	410	2132	59.86	CS	
265	617	94.61	1722	409	2132	58.70	CS	
266	618	94.91	1726	416	2138	58.93	CS	
267	619	95.21	1729	412	2131	58.25	CS	
268	620	94.81	1756	404	2138	59.69	CS	
269	621	95.41	1800	418	2132	60.06	CTV	
270	622	94.51	1802	404	2140	60.02	CTV	
271	623	94.71	1806	409	2138	58.56	CTV	
272	624	94.71	1809	412	2138	58.44	CTV	
273	625	94.81	1812	412	2138	59.41	CTV	
274	626	94.71	1815	432	2181	58.86	CTV	Propellant charge, 155-mm, XM119, lot RAD-64657.
275	627	95.01	1818	438	2181	58.55	CTV	Propellant charge, 155-mm, XM119, lot RAD-64657.

Group 6

Date Fired: 11 May 1966.

276	628	95.11	0920	548	2321	58.19	HC	Zone 8 only.
277	629	94.81	0938	588	2391	60.21	HC	Zone 8 plus 8 ounces, hereafter. Noisy at gun.
278	630	94.91	0941	590	2375	58.38	HC	
279	631	94.71	0944	586	2353	58.50	HC	
280	632	95.31	0949	600	2373	58.07	HC	

APG Sample No.	Tube Rd No.	Proj Wt, lb	Time Fired	PEP, psi/100	MV, fps	Time to Funct, sec	Pretest of Fuze	Remarks
281	633	95.41	0953	601	2373	59.57	HC	
282	634	94.71	0957	603	2385	59.66	HC	
283	635	95.11	1000	590	2372	59.04	HC	
284	636	95.41	1003	582	2347	58.42	HC	
285	637	95.41	1005	591	2356	59.03	HC	
286	638	95.61	1008	586	2369	59.50	HC	
287	639	94.91	1011	597	2360	-	HC	Noisy at gun (rotat- ing band off). No sight - no sound - dud.
288	640	94.41	1014	594	2373	58.85	HC	
Weapon: 155-mm, SP, M109, No. 12V023 (new tube).								
289	9	94.81	1251	560	2326	58.26	HC	Zone 8 only.
290	10	95.11	1256	581	2367	57.96	HC	Zone 8 only.
291	11	94.61	1304	562	2327	59.29	HC	Zone 8 only.
292	12	95.11	1307	570	2330	58.18	HC	Zone 8 only.
293	13	95.21	1310	558	2317	58.17	HC	Zone 8 only.
294	14	94.71	1313	564	2331	58.11	HC	Zone 8 only.
295	15	95.51	1316	564	2320	58.18	HC	Zone 8 only.
296	16	95.21	1320	560	2319	58.56	HC	Zone 8 only.
297	17	95.11	1322	552	2305	58.23	HC	Zone 8 only.
298	18	95.51	1326	554	2306	58.90	HC	Zone 8 only.
299	19	94.61	1328	587	2363	58.13	HC	Zone 8 plus 4 ounces hereafter.
300	20	94.51	1335	585	2350	58.26	HC	
301	21	95.01	1338	584	2336	58.57	HC	
302	22	95.11	1341	584	2351	58.53	HC	
303	23	94.31	1345	601	2366	58.18	HC	
304	24	94.91	1348	609	2380	59.27	HC	
305	25	94.61	1351	582	2358	58.79	HC	
306	26	95.01	1356	588	2340	58.88	HC	
307	27	95.11	1405	598	2339	58.80	HC	
308	28	95.31	1430	575	2328	59.32	HC	Zone 8 plus 2 ounces hereafter.
309	29	94.61	1435	579	2377	58.96	HC	
310	30	94.81	1438	583	2346	58.91	HC	
311	31	94.91	1442	561	2321	59.24	HC	
312	32	95.01	1446	580	2337	58.73	HC	
313	33	95.01	1448	562	2334	59.91	HC	
314	34	94.71	1453	578	2344	59.20	HC	
315	35	95.81	1456	606	2348	58.54	HC	
316	36	94.81	1508	601	2357	58.94	HC	
317	37	95.21	1512	598	2346	58.94	HC	

APG Sample No.	Tube Rd No.	Proj Wt, lb	Time Fired	PEP, psi/100	MV, fps	Time to Funct, sec	Pretest of Fuze	Remarks
318	38	95.01	1516	570	2333	59.67	HTV	
319	39	94.91	1518	600	2363	59.98	HTV	
320	40	95.01	1522	608	2361	59.02	HTV	
321	41	94.91	1525	598	2348	58.60	HTV	
322	42	95.11	1527	600	2351	58.88	HTV	
323	43	95.11	1531	609	2360	59.23	HTV	
324	44	95.11	1534	584	2341	59.50	HTV	

Date Fired: 12 May 1966.
Tube Elevation: 162 mils.
Fuze Setting: 15 seconds.

325	45	94.31	0940	572	2330	14.80	A HC	Zone 8, poor start.
326	46	95.11	0943	578	2340	14.76	HC	Zone 8 plus 2 ounces.
327	47	94.91	0946	568	Lost	14.49	HTV	Zone 8 plus 2 ounces.
328	48	94.91	0952	594	2356	14.54	HTV	Zone 8 plus 2 ounces.
329	49	94.71	0955	606	2375	14.69	HTV	Zone 8 plus 4 ounces.
330	50	95.21	0958	620	2381	14.53	HTV	Zone 8 plus 4 ounces.
331	51	94.91	1001	588	2352	14.85	HTV	Zone 8 plus 2 ounces hereafter.
332	52	95.11	1004	588	2348	14.71	V	
333	53	95.01	1008	583	2352	19.69	A V	Zone 8 plus 2 ounces hereafter. Time to impact - dud.
334	54	94.71	1011	582	2343	14.73	HTV	
335	55	94.91	1013	574	2351	14.58	HC	
336	56	94.91	1016	580	2341	14.63	HC	
337	57	95.11	1020	590	2351	14.62	HC	
338	58	95.11	1023	592	2355	14.58	HC	
339	59	96.01	1025	578	2338	14.85	HC	
340	60	94.61	1027	579	2350	14.83	HC	
341	61	94.61	1030	592	2357	14.57	HN	
342	62	95.21	1033	603	2362	14.87	HN	
343	63	95.21	1035	581	2349	14.82	HN	
344	64	95.01	1039	600	2348	15.10	A HN	False start - short.
345	65	94.81	1042	601	2350	15.20	HN	Noisy at gun - short.
346	66	94.81	1045	604	2367	14.81	HN	
347	67	95.11	1048	600	2360	14.88	HN	
348	68	95.11	1051	602	2359	14.81	HN	
349	69	95.01	1053	568	2329	14.75	HN	
350	70	94.81	1056	593	2356	14.75	HN	

ARSENAL PLANT, OR DISTRICT Lone Star Army Ammo. Plant Texarkana, Texas		AMMUNITION DATA CARD		NET QUANTITY 703	LOT NUMBER LS-1-2	
ITEM Fuze, MT, XM595		APSA ITEM NO 240565		PACKING OF LOT 1 Fuze/MTL can, 15 Cans(15 Fuzes)/wdn. box		
CONTRACTOR Day & Zimmermann, Inc.	CONTRACT OR ORDER NO DA-11-173-AMC-114 (A)	DRAWING AND REVISION None(See Remarks)		SPEC AND REVISION See Remarks		
DATE STARTED 4-21-66	DATE COMPLETED 4-21-66	DATE INSPECTED 4-21-66		LINE K	ZONE WT SHELL	
CHARGE WEIGHT	EXPECTED MUZZLE VELOCITY	EXPECTED PRESSURE		SHELL WEIGHT		
NO OF BALLISTICS SAMPLES None	SENT TO <input type="checkbox"/> JEFF P G	<input type="checkbox"/> YUMA P G	DATE SENT	SENT BY		
COMPONENTS						
COMPONENT	DRAWING NO	MODEL	MANUFACTURER	DATE MFG	LOT NO	QUANTITY
Fuze, MT, M565 Sub Assembly	10522992		Westclox	1963	WTX-2-7	703
Fuze, Safety Adapter Assembly	10534290		Ingraham Co.	1964	ING-1-8A	703
Cup, Booster	8595509		Ingraham Co.	1964	ING-1-8A	703
Pellet, Booster	8595510		Ingraham Co.	1964	ING-1-8A	703
(CONTINUED ON BACK IF NECESSARY)						
DISPOSITION FINALLY ACCEPTED			INSPECTOR'S SIGNATURE AND TYPED NAME <i>Imogene M. English</i> IMOGENE M. ENGLISH			

LS-1-2

Fuze, MT, XM595

Lot manufactured by removing Fuze Safety Adapter Assembly, Booster Cup and Booster Pellet from Fuze, MTSQ, M564 and assembling to Fuze Sub Assembly M565.

Weight 48 lbs.
Cube .8

ENGINEERING AND ENVIRONMENTAL TEST BRANCH

DYNAMIC TEST SECTION

skc

DATE: 18 May 1966

USATECOM

PROJECT NO: 2-3-0028-04

REPORT NO: 66-143

LABORATORY SIMULATED TRANSPORTATION

VIBRATION TEST OF FUZE, MT, XM595

DATES OF TEST: 28 April thru 1 May 1966

PREPARED BY: J. A. ROBINSON

APPROVED:

Ray L. Wiles
RAY L. WILES

Chief

Engineering & Environmental Test Branch

ABERDEEN PROVING GROUND, MARYLAND

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SECTION 1. GENERAL

1.1 Objective

To evaluate the effects of simulated transportation and extreme temperature environments of Fuze, MT, XM595.

1.2 Background

Not Applicable

1.3 Description of Material

There were 60 Fuzes, MT, XM595 subjected to this test. Each was packed in a metal can with 15 cans per wooden box. The box was 16-3/4 inches long by 9-3/4 inches wide by 9 inches high and weighed 48 lb. The explosive content of a fuze was 375 grains of Tetryl.

1.4 Conclusions

The fuzes will remain safe to handle and will function properly after subjection to laboratory simulated transportation vibration at extreme temperatures.

1.5 Recommendations

Not Applicable

1.6 Observations

Not Applicable

1.7 References

Not Applicable

SECTION 2. DETAILS OF TEST

2.1 Laboratory Simulated Transportation Vibration

2.1.1 Objective

To subject the Fuze, MT, XM595 to the combined environments of extreme temperatures and laboratory simulated two-wheeled trailer and aircraft transportation vibration.

2.1.6 Method

Thirty fuzes were temperature conditioned at $-65^{\circ}\text{F} \pm 5^{\circ}\text{F}$ for 17-1/2 hours prior to vibration at the same temperature. A like amount of fuzes were conditioned at $+145^{\circ}\text{F} \pm 5^{\circ}\text{F}$ for 22 hours prior to vibration at the same temperature. Six thermocouples were positioned around the boxes, as shown in Appendix I-1, to monitor the test temperatures during conditioning and vibration.

The fuzes were vibrated in one load at each temperature. The two boxes were mounted in one stack on the large vibration table of the C125 electrodynamic vibration exciter using steel, clamp-type fixtures as shown in Appendix I-1.

The test schedule simulating the vibration environment of 1000 miles of two-wheeled trailer and 3 hours of aircraft transportation in accordance with TECP 700-700, Interim Pamphlet 70-73, was as follows:

a. Two-Wheeled Trailer Phase - The fuzes were cycled from 5.5 to 7 cps at 1.0 inch, DA, input and from 7 to 37 cps at 2.5 g input for 15 minutes at a sweep rate of 3.3 minutes. minimum to maximum frequency.

b. Aircraft Phase - The fuzes were cycled from 37 to 52 cps at 0.036 inches, DA, input and from 52 to 500 cps at 5 g input for 3 hours at a sweep rate of 4.2 minutes, minimum to maximum frequency.

2.1.3 Results

The fuzes were safe to handle and they all functioned properly when fired.

2.1.4 Analysis

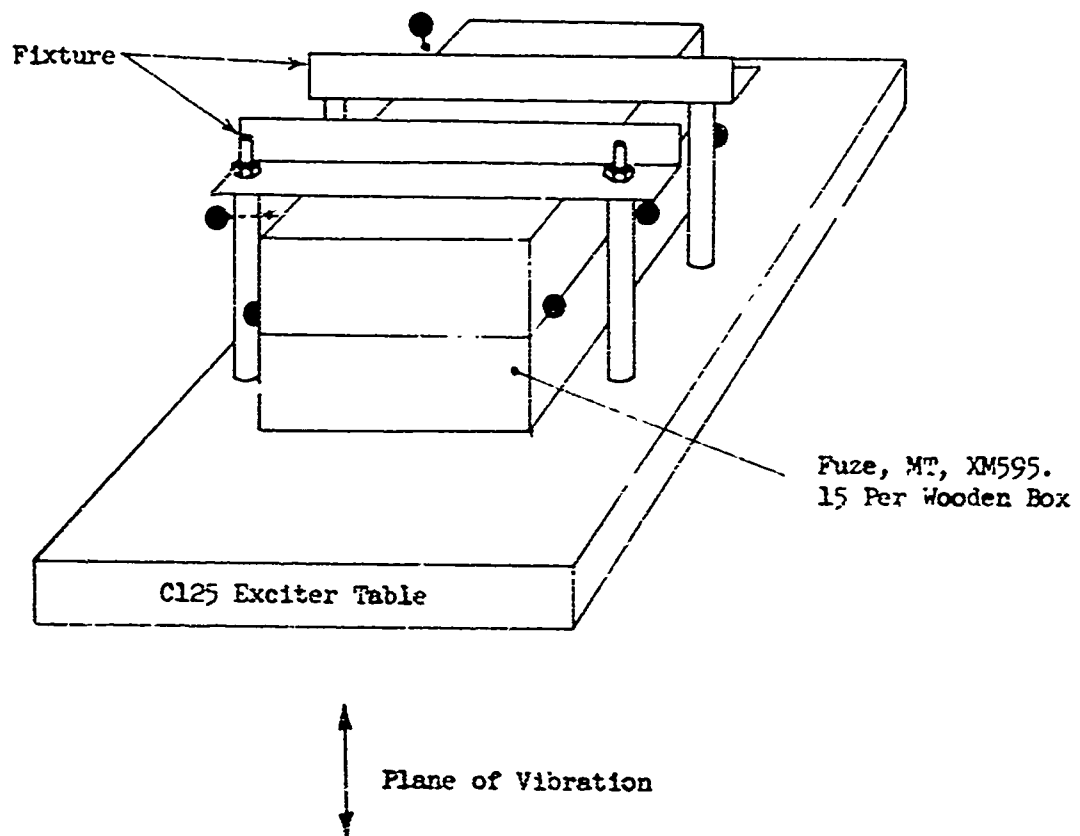
Not Applicable

SECTION 3. APPENDIX

I Test Data

I-1 Load Orientation, Fixture, Plane of Vibration and Thermocouple
Locations

LOAD ORIENTATION, FIXTURE, PLANE OF VIBRATION, AND
THERMOCOUPLE LOCATION DURING LABORATORY SIMULATED TRANSPORTATION
VIBRATION TEST OF FUZE, MT, XM595



● — Thermocouple Location

I-1

I-23

APPENDIX II - DEFICIENCIES AND SHORTCOMINGS

1. DEFICIENCIES

None.

2. SHORTCOMINGS - TEST ITEM

None.

3. SHORTCOMINGS - SUPPORTING AMMUNITION COMPONENTS

<u>SHORTCOMINGS</u>	<u>SUGGESTED CORRECTIVE ACTION</u>	<u>REMARKS</u>
The rotating bands came off two M107 projectiles (evidenced by smear photographs near the muzzle).	Unknown.	Since this was a worn tube and these rounds were fired at chamber pressures in excess of 116% of WRMP, it is possible that the rotating band is reaching its design limitations.
One M82 primer from lot LS-103-25 misfired.	Unknown.	
Several hangfires occurred on the XM119E4 propelling charge at -65°F.	Unknown.	These charges have been stored at APG for at least 6 months.
The clean burning igniter of the XM119E4 propelling charge failed to ignite the rest of the charge on two charges at -65°F.	Unknown.	Same as above.

APPENDIX III - PHOTOGRAPHS

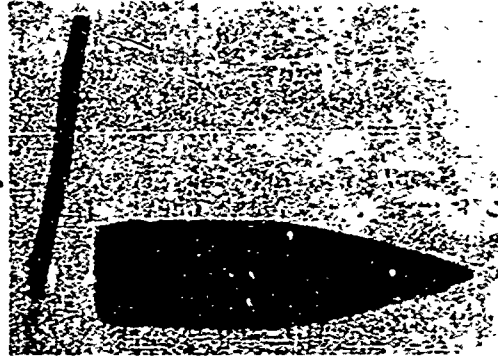


Figure III-1: Sample No. APG 238, Tube Round 590. Projectile and Fuze Fired at +145°F with Propelling Charge (at +155°F) Plus 8 Ounces Giving Chamber Pressure of 58,500 PSI (116% of WRMP). Round Extra Noisy at Gun Site; Failed to Function.



Figure III-2: Sample No. APG 277, Tube Round 629. Projectile and Fuze Fired at +145°F Propelling Charge (at +155°F) Plus 8 Ounces Giving Chamber Pressure of 58,800 PSI (117% of WRMP) Round Noisy at Gun Site; Functioned Satisfactorily.



Figure III-3: Sample No. APG 286, Tube Round 638. Projectile and Fuze Fired at +145°F with Propelling Charge (at +155°F) Plus 8 Ounces Giving Chamber Pressure of 58,600 PSI (116% of WRMP). Round Representative of Those Giving No Trouble.



Figure III-4: Sample No. APG 287, Tube Round 639. Projectile and Fuze Fired at +145°F with Propelling Charge (at +155°F) Plus 8 Ounces Giving a Chamber Pressure of 59,700 PSI (118% of WRMP). Round Noisy at Gun Site and Reported as No-Sight-No-Sound by Observers. Rotating Band Missing.



Figure III-5: Sample No. APG 345, Tube Round 65. Projectile and Fuze Fired at +145°F with Propelling Charge (at +155°F) Plus 2 Ounces Giving Chamber Pressure of 60,100 PSI (119% of WRMP). Round Noisy at Gun Site; Reported Short by Observers but Functioned Satisfactorily.

APPENDIX IV - CORRESPONDENCE



DEPARTMENT OF THE ARMY
HEADQUARTERS, U. S. ARMY TEST AND EVALUATION COMMAND
ABERDEEN PROVING GROUND, MARYLAND 21005

AMSTE-FA

26 APR 1966

SUBJECT: Safety Release of Fuze, MT, XM595

TO: Commanding Officer
Aberdeen Proving Ground
ATTN: STEAP-DS-TA
Aberdeen Proving Ground, Maryland 21005

1. References:

a. Message 13410 from COMUSMACV, dated 18 April 1966, and retransmitted to USATECOM from USAMC on 22 April 1966 (copy forwarded to APG, ATTN: STEAP-DS-TA, on 25 April 1966).

b. Conference held at USAMC on 21 April 1966, Subject: Jungle Canopy Penetration Fuze.

c. Briefing for Col William L. Clay, Director, D&PS, APG, Md., on 25 April 1966, Subject: Jungle Canopy Penetration Fuze.

2. Request Aberdeen Proving Ground conduct a safety evaluation of the Fuze, MT, XM595 so that this headquarters can issue a safety release on the XM595 Fuze for use with the 105MM Projectile, HE, M1, fired from 105MM Howitzers, Towed, M101A1 and M102; with the 155MM Projectile, HE, M107, fired from the 155MM Howitzers, SP, M109, and Towed, M114; and with the 8-Inch Projectile, HE, M106, fired from the 8-Inch Howitzers, SP, M110, and Towed M115.

3. The Fuze, MT, XM595, consists of the safety adapter from the Fuze, MTSQ, M564, assembled with Fuze, MT, M562.

4. The safety evaluation by Aberdeen Proving Ground should be conducted in accordance with TECP 700-700, Interim Pamphlet 10-100, dated 15 November 1965, and should consist of firing the XM595 Fuze with the following rounds after appropriate temperature conditioning and vibration:

AMSTE-FA

SUBJECT: Safety Release of Fuze, MT, XM595

26 APR 1966

<u>Weapon*</u>	<u>Projectile</u>	<u>Prop Charge</u>	<u>No. Rds</u>
Howitzer, 105MM, M101A1	HE, M1	M67, Zone 7	160
Howitzer, 105MM, M102	HE, M1	M67, Zone 7	50
Howitzer, 155MM, M109	HE, M107	XM119E4, Zone 8	160
		TOTAL	370

*No firings from the 8-Inch Howitzers are necessary because the firings above will provide greater set-back forces, velocity, acceleration, and spin to the XM595 Fuze than when fired from an 8-Inch Howitzer.

5. This test is to be conducted under an O2 priority, and the test must be completed no later than 16 May 1966.

6. USAMUCOM is furnishing Aberdeen Proving Ground \$55,000 to conduct this test. In accordance with instructions issued by USAMC and USAMUCOM at conference, reference l.b., pending receipt of the \$55,000, Aberdeen Proving Ground is to use PEMA Funds available for the M564 or M565 Fuze, in order to start the test immediately. Therefore, request Aberdeen Proving Ground use funds under AMCMS Code 4810.16.4718, Pron A1-5-Z0039-01-F0-K2 until the \$55,000 is received.

7. USATECOM Project No. 2-3-0028-04 is assigned to this test and completed TSMS STE Form 1028 is inclosed.

FOR THE COMMANDER:

1 Incl w/d
as

M. D. Kaplan
M. D. KAPLAN
Chief Technical Assistant
FA Materiel Testing Directorate

Copies furnished:

CG, USAMC, ATTN: AMCRD-DW
(Mr. S. W. Swipp) w/o Incl
CG, USAMUCOM, ATTN: AMSMU-RE
(Mr. John Sagarese) w/o Incl
CO, Pic Ars, ATTN: SMUPA-DR5
(Mr. W. A. Schuster) w/o Incl

AD Accession No.
Development and Proof Services, Aberdeen Proving Ground, Md.
Report of USATECOM Project No. 2-3-0028-04, Final Report of Technical Support
Test of Fuze, MT, XM595 (Safety Release), June 1966
RDT&E Project No. Not Available, Report No. DPS-2063
Author H. L. Adams
Secondary distribution controlled by US Army Munitions Command, ATTN: AMSMU-RE
45 pages, 5 illustrations

Unclassified Report

In April and May 1966, 370 of the XM595 fuzes were tested at APG to evaluate the safety of the XM595 mechanical time fuze. The fuzes were subjected to simulated transportation - vibration tests at hot and cold temperatures, cold storage, and hot cycle tests, prior to firing. It is recommended that the XM595 mechanical time fuze be considered safe in any of the following weapon - ammunition combinations: cartridge, 105-mm, M1 in 105-mm howitzers, M101A1, M102, and M108; projectile, 155-mm, M107 with charges, propelling, M3, M4A1, and XM119 series as applicable in 155-mm howitzers, M114A1, and M109; and projectile, 8-inch, M106 with charges, propelling, M1, and M2 in 8-inch howitzers, M55, M110, and M115.

AD Accession No.
Development and Proof Services, Aberdeen Proving Ground, Md.
Report of USATECOM Project No. 2-3-0028-04, Final Report of Technical Support
Test of Fuze, MT, XM595 (Safety Release), June 1966
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Unclassified

Security Classification

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		2b GROUP
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4 DESCRIPTIVE NOTES (Type of report and inclusive dates)		
Final Report April and May 1966		
5 AUTHOR(S) (Last name, first name, initial)		
Adams, H. L.		
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11 SUPPLEMENTARY NOTES	12 SPONSORING MILITARY ACTIVITY	
None	USAMUCOM	
13 ABSTRACT		
<p>In April and May 1966, 370 of the XM595 fuzes were tested at APG to evaluate the safety of the XM595 mechanical time fuze. The fuzes were subjected to simulated transportation - vibration tests at hot and cold temperatures, cold storage, and hot cycle tests, prior to firing. The firings consisted of 160 rounds of M1 cartridge from the M101A1, 105-mm weapon system at ambient temperatures (60 to 80°F), -65°F and +145°F; 50 rounds of M1 cartridge from the M108, 105-mm weapon system at +145°F; and 160 rounds of M107 projectile with charge, propelling, XM119E4 at zone 8 charge from the M109, 155-mm weapon system at ambient temperature, -65°F and +145°F. It is recommended that the XM595 mechanical time fuze be considered safe in any of the following weapon - ammunition combinations: cartridge, 105-mm, M1 in 105-mm howitzers, M101A1, M102, and M108; projectile, 155-mm, M107 with charges, propelling, M3, M4A1, and XM119 series as applicable in 155-mm howitzers, M114A1, and M109; and projectile, 8-inch, M106 with charges, propelling, M1, and M2 in 8-inch howitzers, M55, M110, and M115.</p>		

DD FORM 1 JAN 64 1473

Unclassified

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	ROLE	WT	ROLE	WT	ROLE	WT

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13. ABSTRACT: Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as (TS), (S), (C), or (U).

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, rules, and weights is optional.